

The Status of Brook Trout Populations in Duncan Creek, Chippewa Co. (WBIC 2150600)

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Introduction

Duncan Creek originates east of New Auburn and flows into the Chippewa River in Chippewa Falls. Four dams on the stream form Lake Como in Bloomer, Tilden Millpond in Tilden, Glen Loch Flowage and Star Lake both in Chippewa Falls. This report covers Duncan Creek upstream of Lake Como (8.5 miles) which is a class I brook trout stream.

Management of Duncan Creek has included stocking, land acquisition, fencing, stream bank brushing, instream habitat improvement, beaver control and fishing regulations. Rainbow trout were stocked from 1938 to 1945. Brook trout were stocked from 1938 to 1956 and from 1960 to 1974. Stocking eventually was discontinued when native brook trout were found to comprise the majority of the population.

Land acquisition along the stream for angler access, streambank protection and habitat improvement began in the early 1960s. In 1985, a master plan for the stream was approved and these lands were consolidated into the Duncan Creek Fishery Area. The fishery area covers Duncan Creek from its headwaters downstream to 190th Avenue, immediately above Lake Como. Approximately 7.8 miles of the stream thread are under Department control through streambank easements (primarily) and Department ownership (181 acres). Three properties along the creek remain totally in private ownership.

Streambank fences were constructed to limit cattle access to the stream and to provide a vegetative buffer for control of runoff. Where necessary, cattle watering areas or crossings were constructed to allow landowner access to the stream and to their adjoining lands. As farming operations ceased, fences have been removed to eliminate maintenance needs. The Duncan Creek Priority Watershed Project, run by the Chippewa County Land Conservation Department, began in 1991. Their efforts have provided additional protection to Duncan Creek through landowner education and cost-sharing programs aimed at improving land use and water quality. Figure 1 shows lands in the watershed under this project that now meet minimum management standards for soil loss, wetland protection, streambank protection, cattle access to streams and the level of phosphorus being delivered to the stream from barnyards.

Habitat improvement projects have been conducted since the 1960s by the Department, Trout Unlimited, Bloomer High School students and the Wisconsin Conservation Corps. The first instream habitat project was conducted in 1964-1967 from CTH SS downstream to approximately 0.9 mile below 85th St. (the Christianson farm), a distance of approximately 3.3 miles. Instream structures were widely spaced and at present are no longer functioning. A more intensive habitat improvement project took place in 1998-2001 from STH 64 downstream through the Christianson farm downstream of 85th St. (Figure 2). The major emphasis of this project was to improve spawning habitat and cover. Riprap and LUNKER structures were used to narrow stream width, create deeper pools and overhead cover, and increase velocity to provide additional scour. Stream bank brushing has been done primarily to increase velocity and improve scour and secondarily to improve angler access.

Annual beaver control and dam removal has helped to reduce beaver populations causing damage to instream habitat. In 1993, 22 beaver and 21 beaver dams were removed from the stream. In 2001, only one beaver and one dam were removed. The fall 2001 aerial survey of beaver dams documented no dams in Duncan Creek, however two beaver were removed in spring 2002.

In 1990, statewide regulations were changed to provide more flexibility in managing trout populations in individual waters. Duncan Creek upstream of STH 64 has a 10 daily bag limit with no size limit to allow anglers to take advantage of a very abundant trout population. Downstream of STH 64, a special regulation is in place to increase the density of larger trout. No trout can be harvested from 8"-12" and the daily bag limit is five, only one of which can be >12 inches. Starting with the 2003 fishing season, the regulation for the entire creek upstream of the Bloomer dam will be a protected slot of 10"-14". The daily bag limit will be five fish with only one over 14". This regulation will simplify the two current regulations into one. It also will allow for the harvest of smaller, more abundant trout while protecting larger individuals to provide for a higher quality size structure.

In 1946, the first survey was conducted in Duncan Creek. The older surveys focused on evaluating the trout stocking program and documented the lack of instream cover, bank cover and pools, and a need for habitat improvement. Pasturing and other farming practices had degraded much of the stream banks. Starting with the 1955 survey, native brook trout were showing up in good numbers. By 1964, approximately 95% of the catch was comprised of native fish.

Surveys in the mid-1960s focused on evaluating the impacts of instream habitat improvements conducted between 1964-1967 from CTH SS downstream to 0.9 mile below 85th St. (Figure 2). From 1964 to 1972, trout densities increased downstream of 85th St. (+50.6%) and between CTH SS and 207th Ave. (+60.3%). However, trout densities decreased 13.5% from 85th St. to STH 64 and 9.6% from STH 64 to 207th Ave. Despite the mixed reaction of population density to habitat improvements, the greatest improvement was in the population size structure. From 1964 to 1972, the number of trout ≥ 8 " showed the greatest improvement. Increases ranged from 185% between CTH SS and 207th Ave. to 398% from 207th Ave. to STH 64. The number of trout ≥ 10 " increased 37% and 850%, at these same sites.

A length frequency survey was conducted at two sites in fall 1989. In fall 1996, the first comprehensive survey of Duncan Creek was conducted to determine the population status of trout. This survey is used to evaluate the impact of the 1990 regulations, and to establish a baseline of data prior to the 1998-2001 habitat improvements.

Methods

A mark and recapture survey was conducted at nine stations (Figure 2) from September 30 to October 9, 1996. Site 1 at 190th Ave. was deemed unsuitable for a survey because of the impounding effects of the Bloomer dam. A fall survey was chosen to avoid conflicts with spring lake surveys, high water levels and anglers. Sites ranging from 1,000 to 1,200 feet were shocked with a DC streamshocker using three electrodes. All trout were collected and measured, and the abundance of other fish species was noted. Weights were taken from 10 fish per inch group. During the marking run, all trout were given a top caudal clip. Population estimates were calculated using the Bailey modification of the Peterson formula.

Proportional stock density (PSD) was calculated using the minimum stock (5") and quality (8") sizes from Anderson 1980. The balance or structure of individual fish populations is evaluated using PSD indices. PSD is the percentage of quality-size fish within the minimum stock-size. The formula is as follows:

$$\text{PSD} = (\text{number of quality-size fish} / \text{number of stock-size fish}) \times 100$$

The terms stock-size, quality-size, and preferred-size compare a fish's length to the angling, world record length for that particular species. For any given species, minimum stock-size is 20-26% of the world record length, quality-size is 36-41% and preferred-size is 45-55% (Anderson 1980).

The relationship of length to weight is equally as important as the length-age relationship (growth rate) in fisheries management. This relationship evaluates the health or condition of a fish. It can be influenced by prey availability, prey size and predator-prey relationships. The relative weight (W_r) index (Anderson 1980) compares the measured weight of a fish to a standard weight. Standard weights for individual species have been developed using length and weight measurements from a wide range of fish surveys. Relative weight (W_r) was calculated using the formula from Hyatt and Hubert (2001) for establishing standard weight values.

Results

Eleven fish species, other than brook trout, were found in Duncan Creek (Table 1). Largemouth bass young-of-the-year (YOY) were common in the lower sections due to the influence of Lake Como. Northern pike were common to abundant in the middle and headwaters areas.

Table 1. Other fish species observed in Duncan Creek, fall 1996

Species	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10
largemouth bass YOY	10	4	1						
northern pike		1			10		5	24	4
white sucker	common	abundant		common	abundant	present	present		
brook lamprey	common	common	common					abundant	
mudminnow	present	present	common	present	present			abundant	
brook stickleback	present				present				
longnose dace	present		common		common		present	common	
creek chub	present		common		abundant		present	abundant	abundant
mottled sculpin	common	common		common	present	common	common	common	
redside dace			present		common			common	
johnny darter					present		present	abundant	

Brook trout density ranged from 225 fish per mile at site 9 to 13,829 fish per mile at site 4 (Table 2). The estimated density for the entire stream was 7,901 trout per mile. Sites 2 and 3 had the second and third highest trout densities. Sites 2 and 3 are in the special regulation section, while site 4 was immediately upstream of this section. Sites 9 and 10 had significantly lower densities than the remaining sites. The densities of trout $\geq 8"$ and $\geq 10"$ in the special regulation section were 292% and 486% greater than in the base regulation section, respectively.

Table 2. Size distribution of brook trout in Duncan Creek, fall 1996

Site no.	Total no./mile	No. of trout per mile				Percent of population			
		2.0" - 5.9"	6.0" - 7.9"	8.0" - 11.9"	12"+	2.0" - 5.9"	6.0" - 7.9"	8.0" - 11.9"	12"+
2	11,159	8439	1861	832	27	75.6%	16.7%	7.5%	0.24%
3	11,410	9065	1789	542	12	79.4%	15.7%	4.8%	0.11%
4	13,829	12035	1493	296	6	87.0%	10.8%	2.1%	0.05%
5	8,695	7107	1235	342	12	81.7%	14.2%	3.9%	0.11%
6	10,053	8827	1108	120		87.8%	11.0%	1.2%	
7	7,335	5923	1221	188		80.7%	16.6%	2.6%	
8	5,657	4707	766	185		83.2%	13.5%	3.3%	
9	225	75	114	33		33.3%	50.7%	14.7%	
10	408	111	241	49		27.2%	59.1%	12.0%	
2-3	11,386	8835	1840	690	19	77.6%	16.2%	6.1%	0.17%
4-10	6,813	5719	912	180	1	83.9%	13.4%	2.6%	0.01%
all sites	7,901	6468	1131	298	6	81.9%	14.3%	3.8%	0.1%

Approximately 44% of the total catch was $<4"$, which consisted primarily of young-of-the-year individuals (Figure 3). At sites 2-8, a majority of the catch was $<6"$. At sites 9 and 10, trout 6.0" - 7.9" dominated the catch. The special regulation section (sites 2 and 3) had a greater percentage and much higher density of larger trout (Figures 4-6). The percentage of trout $\geq 8"$ and $\geq 10"$ in the special regulation section was 130% and 267% greater than in the base regulation section, respectively.

The PSD value for brook trout in the entire stream was 10. When broken down by regulation section, the PSD was 16 for the special regulation and 7 for the base regulation. No recommended PSD values are known in the literature, however, these values can be used to compare to population size structure in future fall surveys.

Relative weight values for individual size groups were highly variable. All size classes had values >10% below standard weight values. Seven of nine inch groups had values >20% below standard weight values. This is a concern since fall fish should show a better length-weight relationship because of gonadal development.

Habitat conditions at the upstream stations (9 and 10) generally were poor. The stream is relatively wide and shallow with little cover. Banks are overgrown with tag alder, and the stream is braided in areas. Active and abandoned beaver dams were present immediately upstream of and within site 10. Water temperature at these sites was in the mid- to high 50s. Temperature at the downstream sites was around 50 degrees F. or cooler. At sites 2-5 and 7, the substrate is predominantly gravel and rubble. At other sites, sand, muck and detritus are the predominant substrates. Reed canary grass was a problem at sites 3-7. Because of sluggish current, reed canary grass growth occurs instream causing channel braiding and increased sedimentation. At some sites, this growth provided the only cover for fish because of the wide, shallow condition of the channel. Tag alder growth was a problem at sites 2, 4, and 8-10. Site 5 had a problem with large willows toppling over into the stream. Site 8 had a problem with old beaver dams often changing the natural character of the stream, but they did not affect water temperature.

Discussion

Duncan Creek had a very high density of brook trout in 1996 (7,901/mile), however no historical, fall population estimates are available for comparison. Spring population estimates have ranged from 955 trout per mile in 1966 to 1,557 trout per mile in 1972. Some factors which may have aided in the increase in trout density are: better land use practices, land acquisition with the subsequent creation of streambank buffers, improved water quality and habitat conditions, beaver control, and instream habitat improvements.

Trout density in the headwater area of Duncan Creek was significantly lower than in the downstream portions. Specifically, the density of juvenile fish was very low. Factors that may contribute to lower trout density in the upstream portion (sites 8-10) include beaver problems, higher water temperatures due to beaver dams and wetland drainage, degraded habitat conditions and the presence of northern pike. Although beaver have been a problem in the headwaters area for a considerable time, local anglers and landowners have proclaimed a reduction in the number of trout in this area in recent years. Northern pike are a relatively new problem to Duncan Creek. They were illegally introduced into Lake Como in the mid-1980's. They were most common in the headwaters area of Duncan Creek, but also can be found in other stream sections which have large pools. Site 9, which had the highest number of northern pike captured (24), also had the lowest number of trout captured (30). Northern pike predation could be a significant factor in brook trout densities, since there are few other fish species available as prey items.

The special regulation section had a density of trout $\geq 8"$ almost three times greater than in the base regulation section. The density of trout $\geq 10"$ was approximately five times greater. The overall trout density also was highest in the special regulation section and immediately upstream of this section. It is unknown if this difference in density is a result of the special regulation or a function of habitat quality.

With the high density of brook trout in the special regulation section, trout from this section have been used as a source of trout for wild fish transfers. In fall 1988, 1997, 1998, 2000 and 2001, brook trout have been transferred to streams in southwest Wisconsin to reestablish native brook trout populations. In 1998, brook trout also were transferred to Eighteen Mile Creek in Dunn County to reestablish trout populations. The following numbers and sizes were removed:

<u>Year</u>	<u>Number</u>	<u>Size</u>	<u>Transferred to</u>
1988	1,406	most <7"	SW Wisconsin
1997	495	most <8"	Seas Branch Cr.
1998	285	<6"	Eighteen Mile Cr.
1998	300	6"-9"	Eighteen Mile Cr.
2000	2,045	mean 5"	SW Wisconsin
2001	1,998	most <7"	SW Wisconsin

To insure that communicable diseases were not being spread to other streams, trout were tested for six diseases in 2000. All tests came back negative for any sign of disease.

Figures 7 and 8 provide insight into the trout size structure over the years. For spring surveys, the 1967 population had the best size structure for fish $\geq 8"$, followed by the 1972 and 1966 populations. The percent of trout $\geq 12"$ was highest in the 1967 population (2.6%), immediately after habitat improvements were completed. The size structure of the fall 1989 population resembled the size structure of the early 1960s prior to the initial round of instream habitat improvements. Only 0.1% of the fall 1989 population was $\geq 12"$ prior to the onset of the 1990 regulation change (Figure 8). After seven years under the new regulations, still only 0.2% of the trout in the entire stream were $\geq 12"$. However, when the size structure between the base regulation and the special regulation are compared, more significant improvements in size structure occurred in the special regulation section.

The 1989 and 1996 size structure at site 5 (base regulation) is similar for both years (Figure 9). This is reflected in PSD values. At site 3 (special regulation), the percent of trout $\geq 7"$ in 1996 was approximately double the 1989 population (Figure 10) which is reflected in PSD values. Similar differences are seen between the special regulation section and the base regulation section in the 1996 population (Figure 11). It is evident that the special regulation had a positive impact on trout size structure, especially that of larger fish.

In spring 2001, a survey was conducted on the Harley Christianson (downstream of 85th St.) and Ken Hable (upstream of 85th St.) properties. Both sites are in the special regulation section. Habitat improvements on the Hable property were conducted in 1998-1999. Old habitat structures were present on the Christianson property, but they were not functioning well. The 2001 data is not comparable to the 1996 survey because of different sampling seasons. However, the two sites can be compared to one another since trout densities were similar at both of sites in the 1996 survey. Trout density (7,207 fish/mile) in the unimproved section (Christianson's) was 101% higher than in the improved section (3,559 fish/mile) (Hable's). This was influenced by the greater presence of juvenile fish in the unimproved section (Figure 12) where the density of trout $< 5.5"$ was 331% higher than in the improved section. The density of trout $\geq 8"$ was 151% higher in the improved section. No control site(s) were surveyed in the base regulation section to determine if changes in the population occurred throughout the stream. Simply comparing the two 2001 survey sites, habitat improvements apparently have improved the number of larger fish. Trout density in the improved section, especially on smaller fish may have been reduced with the removal of 2,045 juvenile fish (mean size 5") in fall 2000.

Relative weight values are below expected (standard) weight values even with fish in a prespawn condition. It is not known if these are regional differences or if they are related to the high density of trout. To determine if density is a major factor with relative weight values in Duncan Creek, separate weight measurements should be collected at each study site in the future, especially at improved and unimproved sections of the stream.

Conclusions and recommendations

Habitat improvements in the 1960s had mixed impacts to overall density of brook trout, possibly due to the low intensity of improvements. The greatest improvement was in the density of trout $\geq 8"$. The 1996 survey can be used as baseline data to evaluate the more intensive habitat improvements conducted from 1998-2001. It is expected that density will decrease and the percentage of larger trout will increase in the improved section.

The protected slot size of 8"–12" improved the size structure of trout in the special regulation section. In 1996, this section has a significantly higher density of trout $\geq 8"$ and $\geq 10"$ than the base regulation section. The special regulation section also contains overall trout densities that were higher than in the base regulation section. It is not known if the regulation produced these numbers, if the regulation deterred anglers from fishing that section, or if the higher density is a function of habitat.

The spring 2001 survey also indicated a much higher density of trout $\geq 8"$ in the improved vs. the unimproved sections of the special regulation section. The survey also showed a much lower density of trout in the improved section, but this may be a result of a trout transfer which took place in fall 2000.

Based on the results of this survey and the completion of habitat improvements in 1998-2001, the following management activities are recommended.

- 1) Change trout regulations to decrease trout density and to provide protection for larger trout.** A regulation change was proposed at the 2002 spring rules hearing which should become effective for the 2003 angling

season. The proposal is a no harvest (protected) slot of 10"–14" with a daily bag limit of 5 of which only one fish can be >14". This regulation will apply to Duncan Creek and Lake Como, simplifying the current, two regulation system. It will allow anglers to harvest more trout in the current special regulation section where densities are very high. With instream habitat improvements, cover has increased significantly, and the numbers of larger fish in this section are expected to increase. The proposed regulation will provide protection to larger fish giving anglers an opportunity to catch trophy brook trout.

2) Conduct a survey to evaluate the combined impacts of the special regulation and habitat improvements.

This survey should be conducted in fall so that the data is comparable to the fall 1996 survey. Survey sites should be selected in the special regulation section where habitat improvements have been made and in the non-improved, base regulation section. To evaluate the impact of trout density on length-weight relationships, a separate weight measurements should be collected in both regulation sections. This survey should be conducted prior to any change in the current regulations to document the impacts of the current regulation along with habitat improvements.

3) Extend the area of habitat improvements upstream of STH 64. Instream habitat conditions upstream of STH 64 are degrading. Thick tag alder brush, toppled trees and heavy reed canary grass growth are blocking stream flows causing channel braiding. Channel width is increasing and depth is decreasing which results in reduced velocities and increased sedimentation. Selective brush removal should be conducted to reduce flow blockages but not increase the spread of reed canary grass. Toppled trees that are causing instream problems should be removed. Instream habitat structures should be placed where necessary to improve channel function and to provide cover.

4) Continue beaver control efforts. Beaver populations and dams have been reduced to a level where they no longer cause significant damage to trout habitat. Control efforts should be continued to prevent beaver populations from expanding to nuisance levels.

5) Continue acquisition of properties within the fishery area boundary. Three land parcels within the boundary remain in private ownership. Efforts should be made to block in the fishery area through streambank easements or with fee title acquisition, whichever landowners prefer. Landowners should be contacted to remind them of our fishery area acquisition project.

6) Control the upstream migration of northern pike and white suckers from Lake Como into Duncan Creek.

Northern pike are common to abundant in the upstream half of Duncan Creek. Northern pike are effective predators on trout and may have an impact on the trout population. At site 9, the northern pike catch was the highest and trout density was the lowest. White suckers, which are common to abundant in the lower portion, compete with trout for food and cover. A 2000 survey of Lake Como found very high densities of both northern pike and white suckers in the lake. These species migrate upstream in spring using the stream for spawning and nursery habitat. With the presence of northern pike YOY in the stream, it is likely northern pike are using the upstream portion for spawning because of slower velocities and thick emergent vegetation. With the ongoing rehabilitation of Lake Como, efforts should be made to reduce the populations of these species in the lake.

7). Use brook trout from Duncan Creek as a source of wild fish transfers unless these transfers cause problems in Duncan Creek populations or trout test positive for a communicable disease. Trout from Duncan Creek have been used successfully to reestablish native brook trout populations in other Wisconsin streams. With the high density of trout in Duncan Creek, this is not expected to cause a problem with the population, and may help with reducing overall densities and improving the length-weight relationship. Trout periodically will need to be tested for diseases prior to transfer in accordance with Department policy. If it is determined that trout transfers are harmful to the Duncan Creek population, this activity should cease.

References

Anderson, R.O. 1980. Proportional stock density (PSD) and relative weight (Wr): interpretive indices for Fish populations and communities. Pp. 27-33 in S. Gloss and B. Shupp (eds). Practical Fisheries Management: More with Less in the 1980's. New York Chapter Amer. Fish. Soc., Bethesda, MD.

Hyatt, M.W. and W.A. Hubert. 2001. Proposed standard-weight equations for brook trout. N. Amer. J. Fish. Mgmt. 21:253-254.

Figure 3. Length frequency of the brook trout catch in Duncan Creek, fall 1996

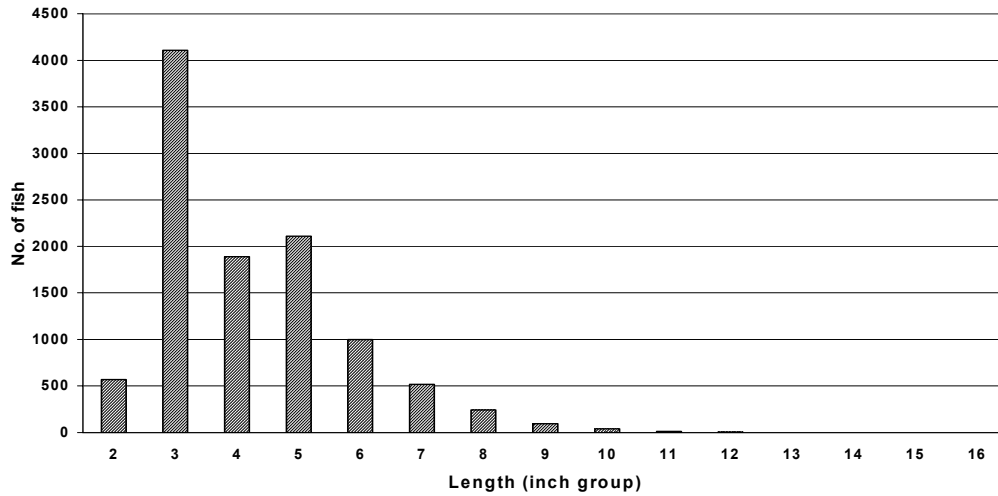


Figure 4. Size distribution of brook trout in the special regulation section of Duncan Creek, fall 1996

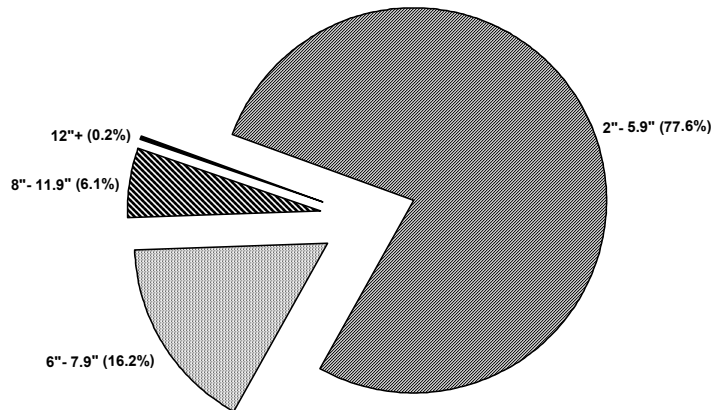


Figure 5. Size distribution of brook trout in the base regulation section of Duncan Creek, fall 1996

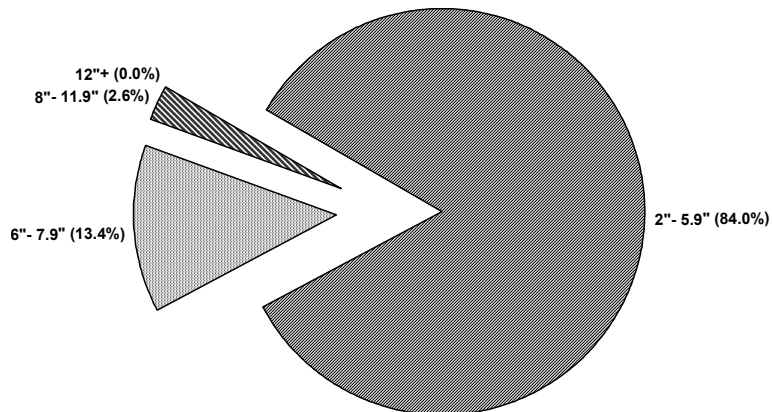


Figure 6. Brook trout density in Duncan Creek by regulation category, fall 1996

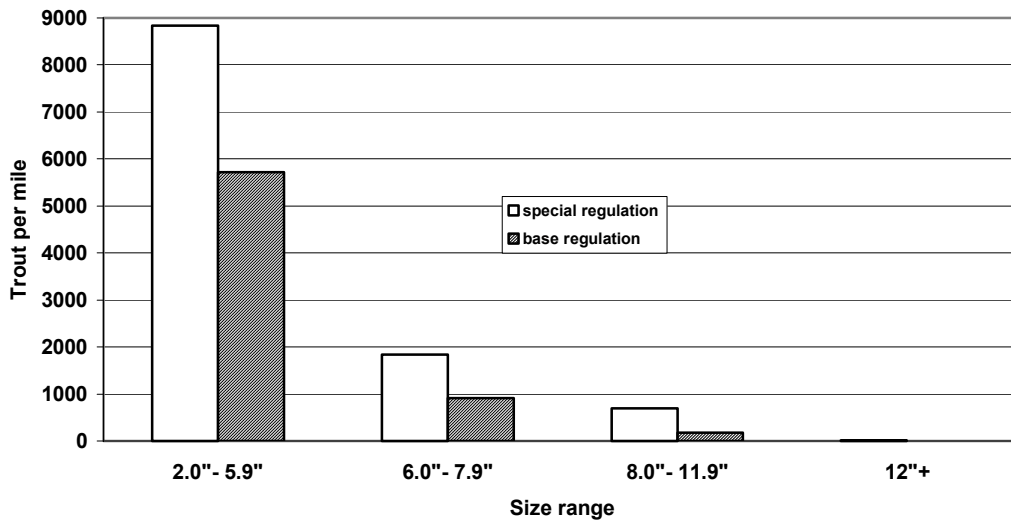


Figure 7. Percent of brook trout 5"+ that were also >8" in Duncan Creek during spring surveys

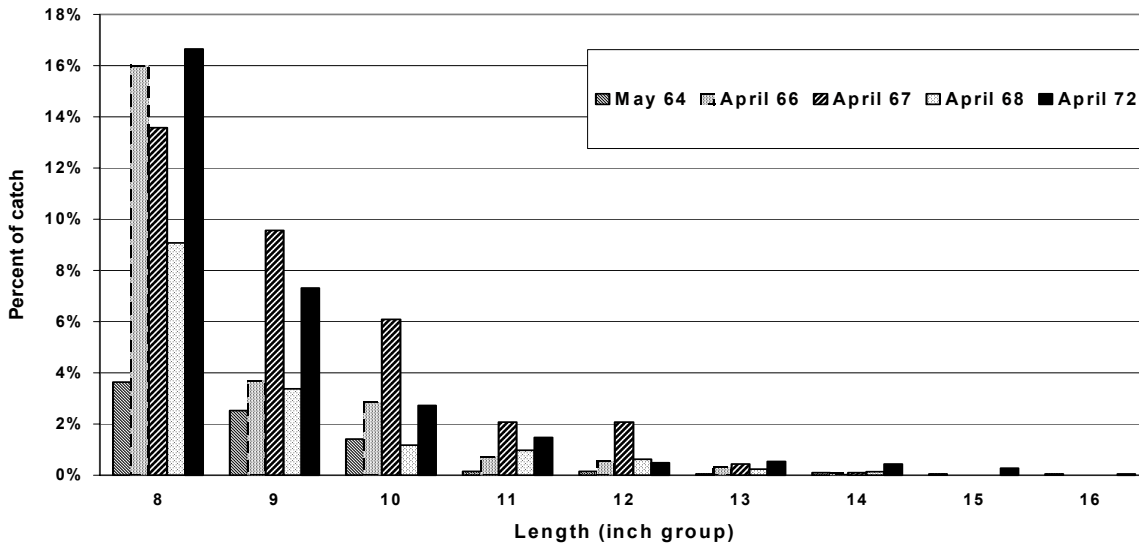


Figure 8. Percent of brook trout 5"+ that were also >8" in Duncan Creek during fall surveys

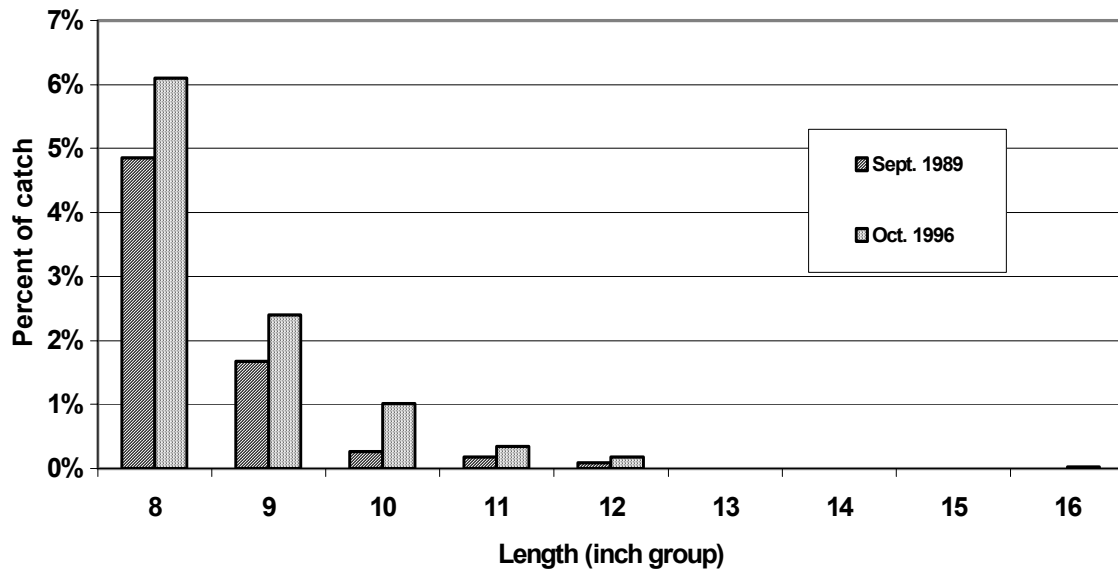


Figure 9. Brook trout length frequency at site 5 (base regulation) in Duncan Creek from fall surveys

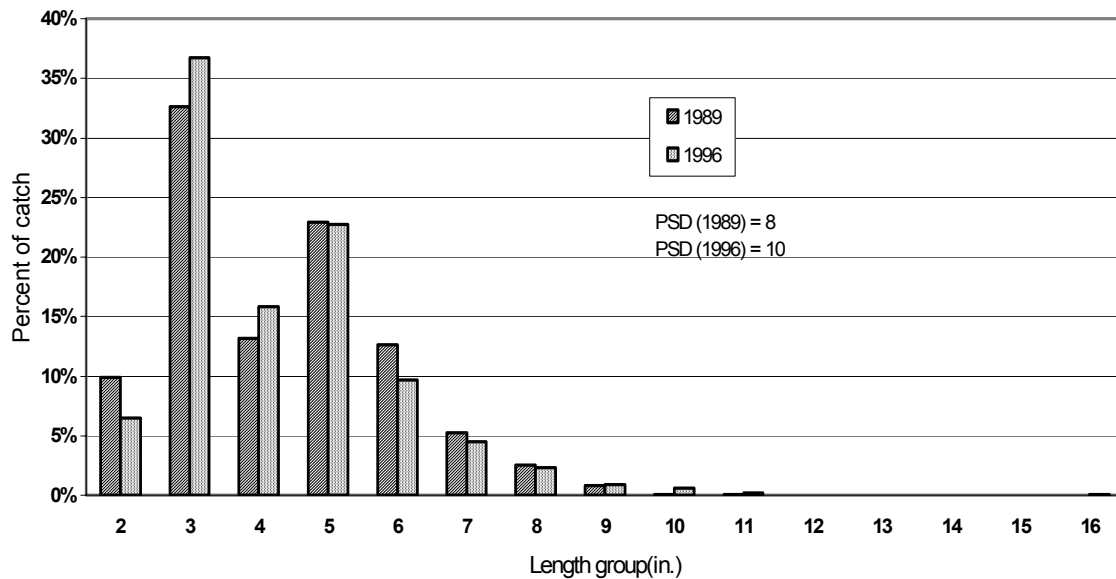


Figure 10. Brook trout length frequency at site 3 (special regulation) in Duncan Creek from fall surveys

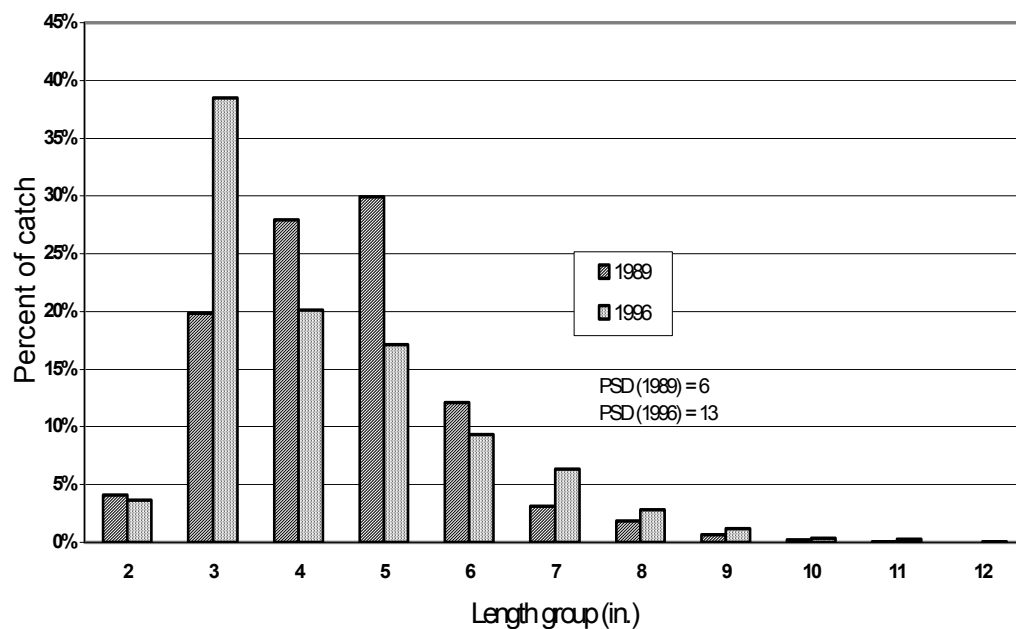


Figure 11. Brook trout length frequency by regulation section for Duncan Creek, fall 1996

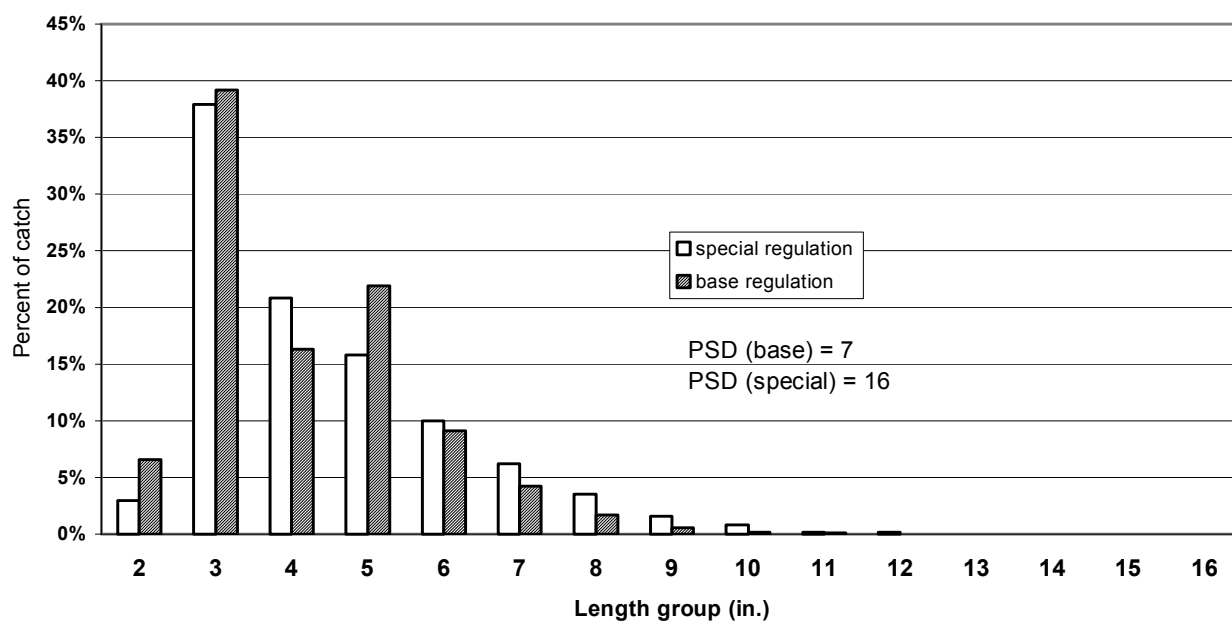


Figure 12. Length frequency of the brook trout catch in Duncan Creek, spring 2001

